

# PROPERTIES OF SOLIDS – ALL TYPES

## Part 1

Nelson *Chemistry 12* p. 273-4. Do Q.2, 5 and 7

## Part 2

1) The electrical conductivity of solid silver is much better than that of molten silver chloride, AgCl. In turn, the electrical conductivity of molten AgCl is much better than that of solid AgCl. Explain these facts.

2) Which type of bonding (van der Waals (London), network covalent, metallic or ionic) is involved in each of the following substances? (Hint: substances may have more than 1 type)

- (a) He(l)      (b) Fe(s)      (c) diamond(s)      (d) CH<sub>4</sub>(g)      (e) KCl(s)      (f) Ag(s),  
 (g) Si(s)      (h) SiO<sub>2</sub>(s),      (i) I<sub>2</sub>(g)      (j) C<sub>2</sub>H<sub>2</sub>(l)      (k) SO<sub>2</sub>(l),      (l) SiC(s)  
 (m) MgO(s)

3) Explain why NaCl dissolves readily in water but very poorly in gasoline (C<sub>8</sub>H<sub>18</sub>).

4) To which class of solid does each of the following belong: NO<sub>2</sub>, BaCl<sub>2</sub>, CBr<sub>4</sub>, SiO<sub>2</sub>, Zn, He, Hg, HBr, Kr, and I<sub>2</sub>?

5) Which of Na, Si, He, KF, and HF in the solid phase, would be an example of:

- a) a solid in which the atoms are covalently bonded together in a network?  
 b) a solid with strong hydrogen bonds?  
 c) a solid which is a good conductor of electricity?  
 d) a substance which does not conduct electricity except in the liquid state?  
 e) a solid held together only by London dispersion (van der Waals) forces?

6) Using the data from Table 1, identify the type of solid and identify the forces of attraction that give each substance its characteristic melting point/boiling point. Remember that you are describing the solid phase of each substance whether it is a solid at room temperature or not.

**Table 1: Properties of Five Substances**

Substance	M.P. (°C)	B.P. (°C)	Electrical Conductivity		Solubility in Water
			Of Solid	Of Liquid	
A	776	1500	poor	good	soluble
B	-39	356	good	good	insoluble
C	-190	-42	poor	poor	low solubility
D	961	1950	good	good	insoluble
E	1420	2355	poor	poor	insoluble

7) Predict the order of increasing melting points for the following chlorine-containing substances: Cl<sub>2</sub>, NaCl, and CCl<sub>4</sub>. Explain your prediction.

8) What kind of attractive force must be overcome to melt the following substances: lithium chloride crystals, ice, solid argon, and silicon dioxide?

9) What type(s) of bonding exists in following substances: solid Ne, Cu, and diamond?

10) Germanium (Ge) is a solid whose atoms are all covalently bonded to each other, much like those of the carbon atoms in a diamond crystal. Glycerol [C<sub>3</sub>H<sub>5</sub>(OH)<sub>3</sub>] is an alcohol. Potassium chloride (KCl) is a white crystalline solid. Methane (CH<sub>4</sub>) is a gas which can be liquefied only under high pressures and low temperatures. Rubidium metal is very malleable and is an excellent conductor of electricity. Which of these substances has (a) hydrogen bonding, (b) the greatest hardness in the solid phase, (c) the highest melting point? (d) good conductivity of electricity when melted, (e) the lowest molar heat of vaporization (i.e. boils at the lowest temperature), (f) particles held together primarily by van der Waals forces?

11) For each of the following pairs of substances, predict which will have the higher melting point and indicate why. (a) CuBr<sub>2</sub>, Br<sub>2</sub>; (b) CO<sub>2</sub>, SiO<sub>2</sub>; (c) S, Cr; (d) CsBr, CaF<sub>2</sub>.

12) Which compound in each of these pairs will have the higher melting point? (a) CaO or KI, (b) KCl or KI, (c) RbCl or ICl